

The In-Situ Measurement of the Hygrothermic State of Thermal Insulations and the Thermal Performance of Capillary-Porous Materials and Building Components

H. Stopp^S and P. Strangfeld^C

FH Lausitz, University of Applied Sciences, Cottbus, Germany

P. Häupl

Technical University Dresden, Dresden, Germany

The saving of energy is a topical problem worldwide. In this connection, the hygro-thermal state of the thermal insulation layer and its material properties in-situ play an important role with regard to the heating losses due to temperature and moisture gradients. To recognize and to describe the complex process, a numerical simulation of the coupled heat and mass transfer in capillary-porous materials and measurement of the thermal conductivity and moisture must be carried out.

In the paper, a measuring tool developed during the last time is demonstrated. Its principle is based on a point-shaped and constant heated heat source with a diameter of 1.5 mm. By means of such a so-called lambda-needle probe, it is possible to record the thermal conductivity dependent on time and location and also to determine the spatial and temporal distribution of moisture content.

Examples of measurements and calculations are represented for envelope parts of buildings, refrigerators and thermal insulated cooling pipes concerning the materials polyurethane, extruded polystyrene and calcium silicate under condition of use. The additional heat losses by enthalpy transfer in the thermal insulation of inverted roofs and district heating pipes in case of leaks are discussed and also the long time hygro-thermal performance of a refrigerator's envelope. Furthermore, the effects of moisture distribution on the heating losses of building structures by the influence of different climate boundary conditions can be seen and measures for improvement are proposed.